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(54) **HAND TOOL PROVIDING DOUBLE COMPOUND LEVERAGE TO THE JAWS**

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See application file for complete search history.

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(57) **ABSTRACT**

A hand tool for use by one hand provides double compound leverage of the force exerted on the handles to the jaws. This is achieved by adding additional pivots and lever arms between the handles and the jaws. The jaws may take the form of a sheet metal snip, seamer, or crimper.

10 Claims, 4 Drawing Sheets

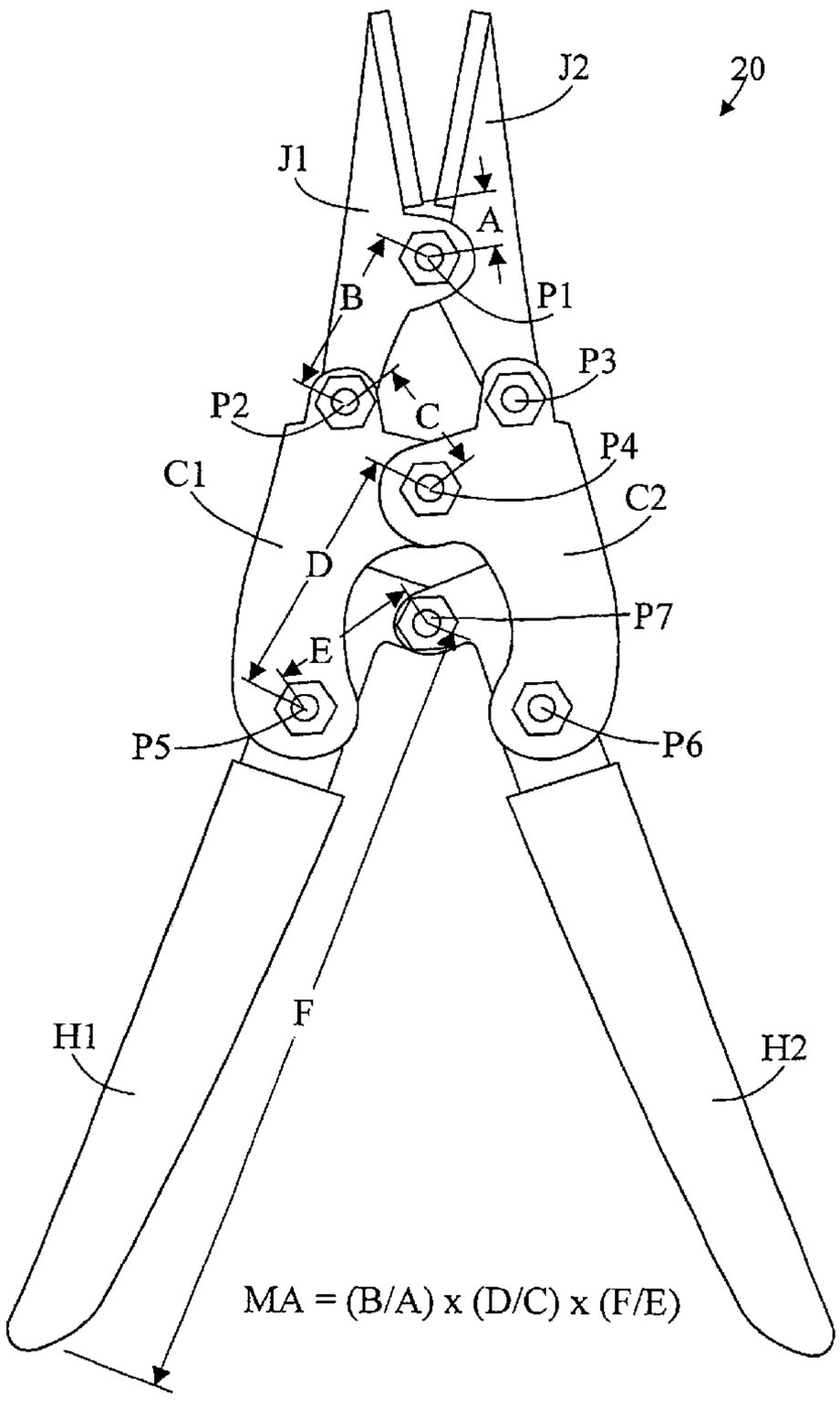


Fig. 1

PRIOR ART

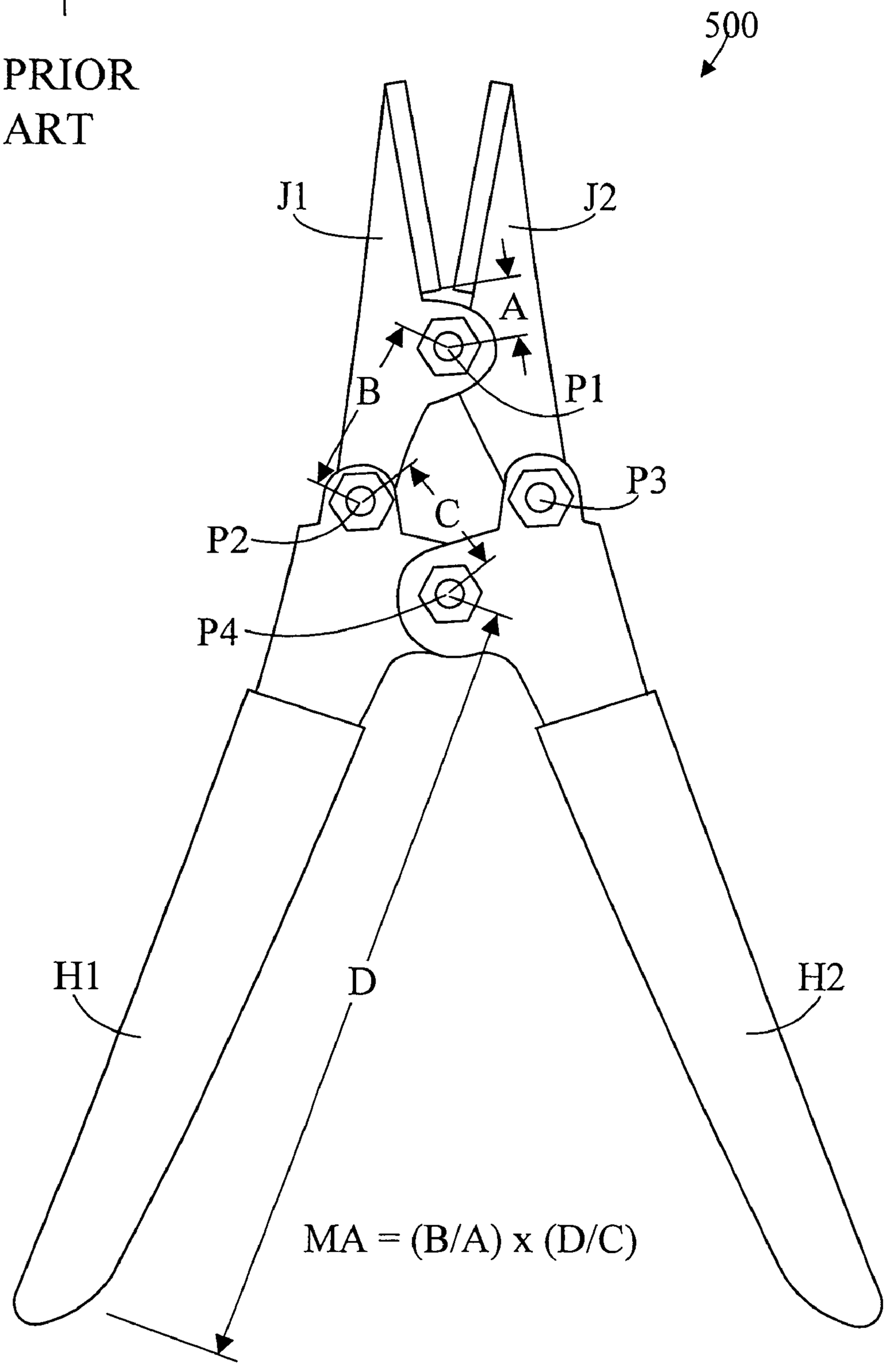


Fig. 2

PRIOR ART

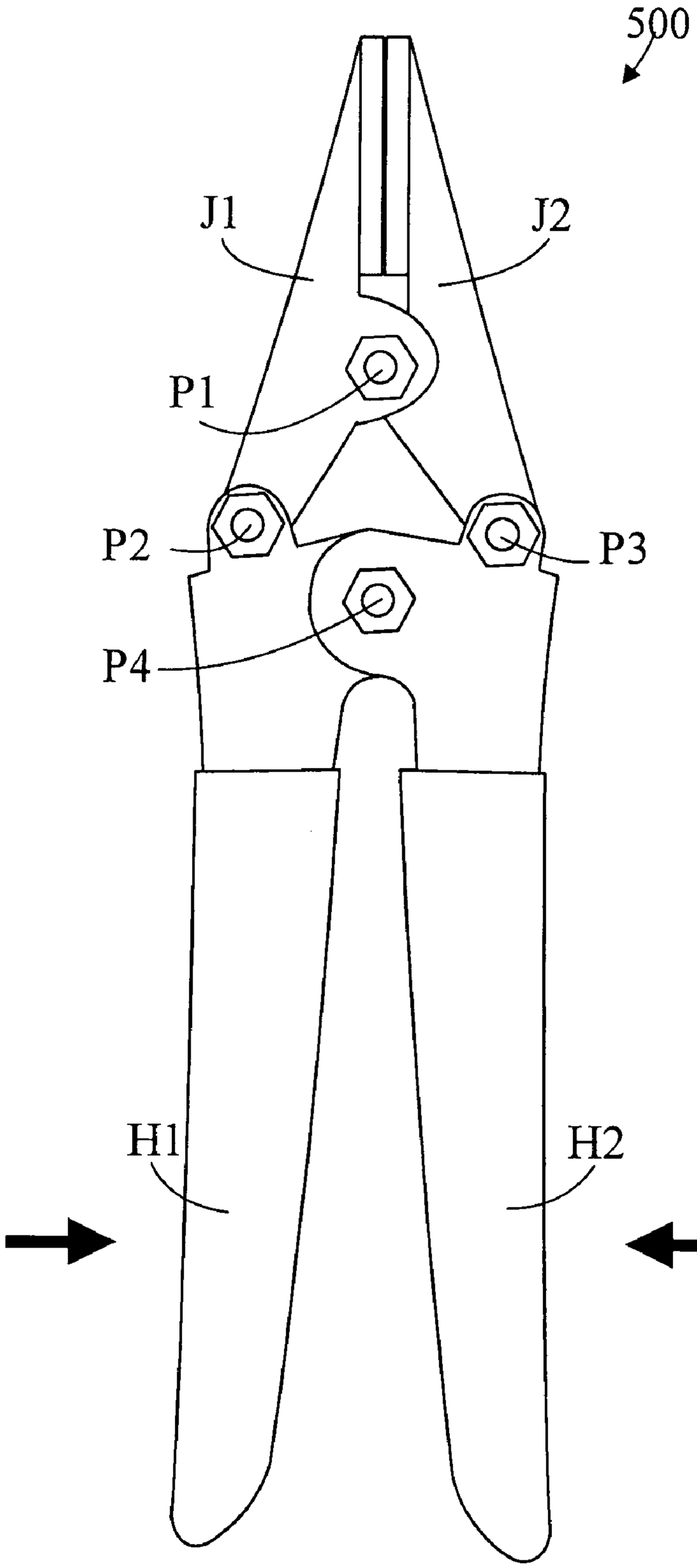
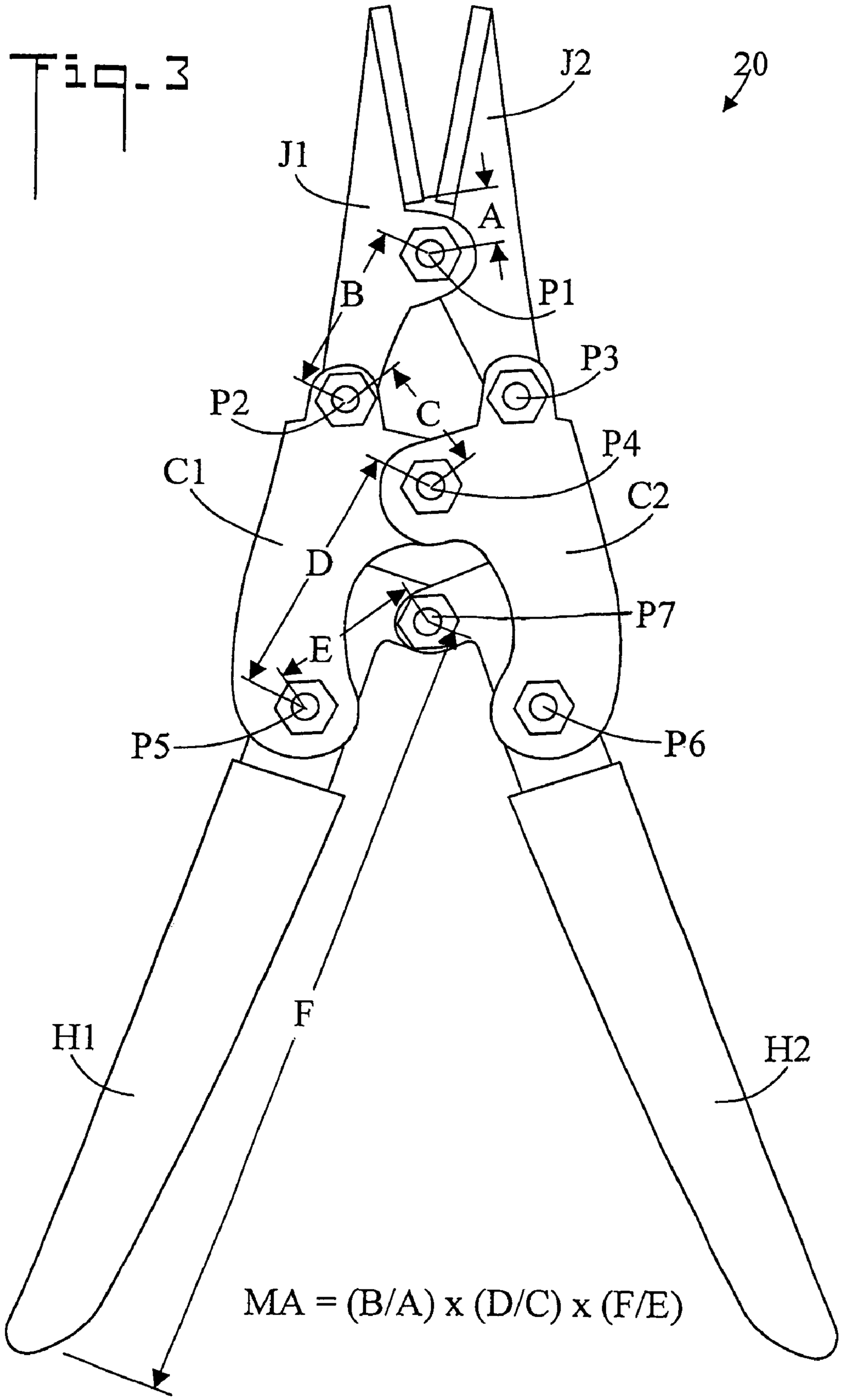
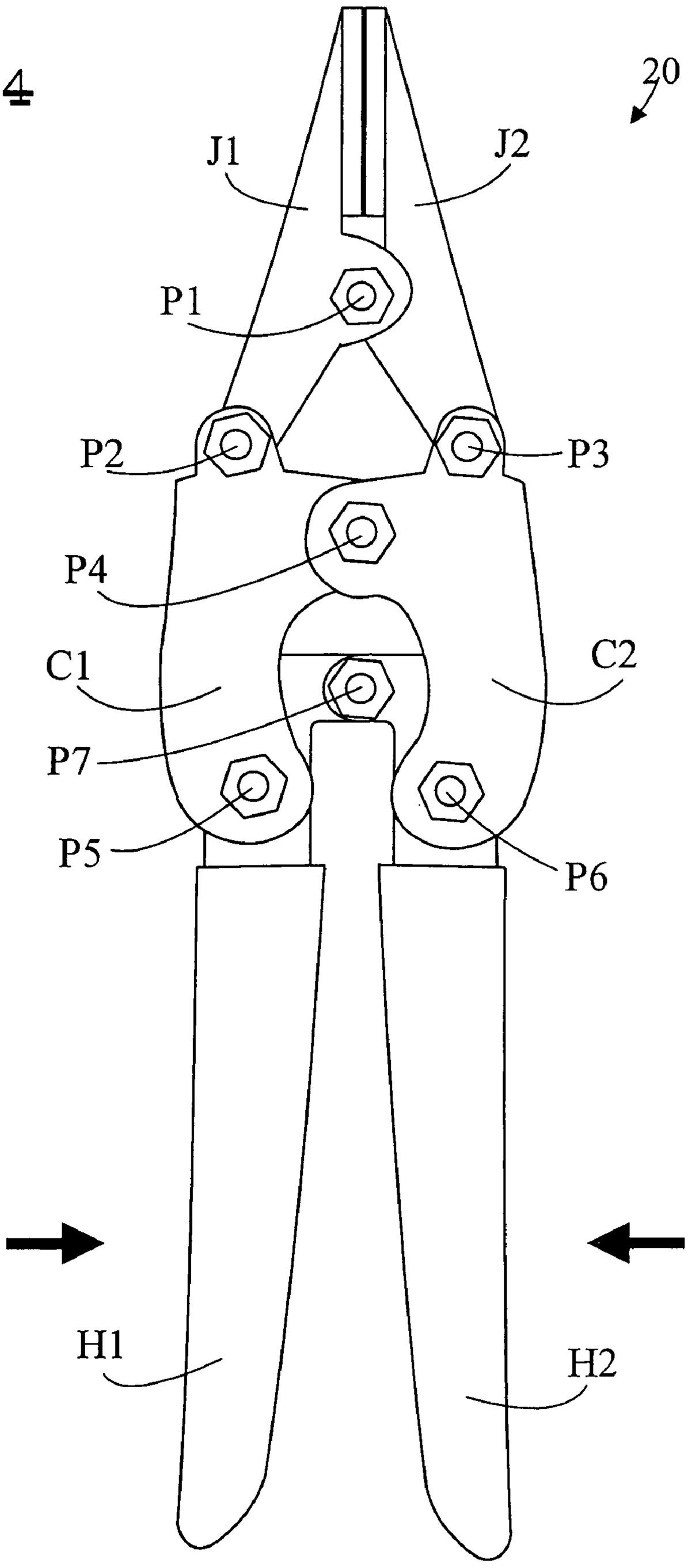


Fig. 3



$$MA = (B/A) \times (D/C) \times (F/E)$$

Fig. 4



HAND TOOL PROVIDING DOUBLE COMPOUND LEVERAGE TO THE JAWS

TECHNICAL FIELD

The present invention pertains generally to hand tools, and more particularly to hand tools that are operated using one hand.

BACKGROUND OF THE INVENTION

Hand tools having two pivotally connected handles for moving jaws that a user operates with one hand are well known in the art. The basic tool has three parts: a unitary first member having a first handle on one end and a first jaw on the other, a unitary second member having a second handle on one end and a second jaw on the other, and an axle pivotally connecting the two together. Scissors and sheet metal snips are examples of such hand tools operated by one hand.

In many applications, the mechanical advantage offered by the simple leverage of three part hand tools is insufficient making it difficult or impossible to achieve the desired result with one hand. For example, cutting, crimping, and seaming sheet metal with a three part hand snipper, crimper, or seamer can require more hand pressure than the user can deliver, particularly when the cutting, crimping, or seaming must be performed over a protracted period of time.

One solution is to provide a compound lever action tool. FIGS. **1** and **2** illustrate side elevation views of such a prior art compound leverage hand tool **500** shown in the open and closed positions, respectively. Hand tool **500** is designed to be operated using one hand. Hand tool **500** has a first jaw member J**1** and a second jaw member J**2**. The intermediate portions of jaw members J**1** and J**2** are pivotally connected at pivot P**1**. Hand tool **500** also has first handle member H**1** and second handle member H**2**. One end of first handle member H**1** is pivotally connected to an end of first jaw member J**1** at pivot P**2**, and one end of second handle member H**2** is pivotally connected to an end of second jaw member J**2** a pivot P**3**. The intermediate portions of first handle member H**1** and second handle member H**2** are pivotally connected together at pivot P**4**. Pivots P**2** and P**3** are disposed between pivots P**1** and pivot P**4**.

In the embodiment shown, first jaw member J**1** and second jaw member J**2** are shaped and dimensioned so that they combine to form a seamer, which is used to press material between the flat plates of first jaw member J**1** and second jaw member J**2**. However, it may be appreciated that hand tools designed for other purposes such as cutting and crimping can also have the same compound leverage structural arrangement of pivots and levers. One such hand tool is the bolt cutter shown in U.S. Pat. No. 484,670 to H. K. Porter. It is noted in this tool that pivot P**1** actually comprises two spread-apart pivots, yet the fundamental principle of the invention is the same as hand tool **500**. It is further noted that hand tool **500** is designed to be used by one hand, whereas the tool of U.S. Pat. No. 484,670 is designed to be used by two hands.

FIG. **1** also shows the lever arms of hand tool **500**. The tool provides compound leverage because it has two sets of levers. Lever arm A is the distance between the crotch of first jaw member J**1** and pivot P**1**. Lever arm B is the distance between pivot P**1** and pivot P**2**. Lever arm C is the distance between pivot P**2** and pivot P**4**. Lever arm D is the distance between pivot P**2** and the distal end of first handle member H**1**. Therefore the mechanical advantage MA of hand tool **500** is MA=(B/A)×(D/C). In the typical hand tool **500** shown, the length of the lever arms are about: A=0.5 inches, B=1.25 inches, C=0.8 inches, and D=5.25 inches. The mechanical advantage MA is therefore MA=(1.25/0.5)×(5.25/0.8)=about 16.4 which is generally referred to as 16.4 to 1.

Additional mechanical advantage can be achieved by adding an additional set of levers to provide the tool with double compound leverage. U.S. Pat. No. 1,348,735 also by H. K. Porter is an example of such a tool. The handles pivot together to provide leverage. The jaws pivot together to compound the leverage provided by the handles. Intermediate links pivot together to doubly compound the leverage provided by the handles. This tool is designed to be used by two hands.

Snippers, crimpers, and seamers having only simple leverage for use by one hand may be satisfactory for work on sheet metal and other applications where the material is very thin and the work to be done does not extend over a long period of time. Snippers, crimpers, and seamers having compound leverage for use by one hand such as tool **500** above may be satisfactory for work on sheet metal and other applications where the material is somewhat thicker. But there are other situations where snippers, crimpers, and seamers having double compound leverage for use by one hand would be advantageous both to work thicker materials and perform the work over longer periods of time and these are not available.

BRIEF SUMMARY OF THE INVENTION

The present invention is directed to a hand tool that has an increased mechanical advantage. The hand tool of the present invention includes additional pivots and lever arms that increase the mechanical advantage of the hand tool, and make the tool easier to operate with one hand. This is accomplished by adding center members between the jaw members and handle members to doubly compound the leverage provided by the handles on the jaws.

In accordance with a preferred embodiment of the invention, a hand tool includes first and second jaw members that are pivotally connected to first and second center members that in turn are pivotally connected to first and second handle members. In all the hand tool of the present invention includes six members that are connected at seven pivot points. This is in contrast to prior art tools for use by one hand that have four members connected at four pivot points. The jaws of the present invention can be adapted to perform a variety of tasks such as cutting, seaming, or crimping sheet metal, cutting vegetation, and other uses.

In accordance with one aspect of the present invention, the overall length of the tool is decreased by placing the pivot for the handles between the pivot for the first and second center members and the pivots connecting the center members to the handles.

In accordance with another aspect of the present invention, the pivots for each of the center members are outside of the pivot between the center members.

Other aspects of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation view of a prior art hand tool shown in the open position;

FIG. **2** is a side elevation view of the prior art hand tool shown in the closed position;

FIG. **3** is a side elevation view of the hand tool of the present invention shown in the open position; and,

FIG. **4** is a side elevation view of the hand tool of the present invention shown in the closed position.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **3** and **4** illustrate side elevation views of a hand tool **20** in accordance with the present invention shown in the open and closed positions, respectively. Hand tool **20** includes a first jaw member J**1** and a second jaw member J**2**. The intermediate portions of jaw members J**1** and J**2** are pivotally connected at pivot P**1**. Hand tool **20** also includes first center member C**1** and second center member C**2**. One end of first center member C**1** is pivotally connected to first jaw member J**1** at pivot P**2**, and one end of second center member C**2** is pivotally connected to second jaw member J**2** at pivot P**3**. The intermediate portions of first center member C**1** and second center member C**2** are pivotally connected together at pivot P**4**.

Hand tool **500** also has first handle member H**1** and second handle member H**2**. An intermediate portion of first handle member H**1** is pivotally connected to the opposite end of center member C**1** at P**5**, and an intermediate portion of second handle member H**2** is pivotally connected to the opposite end of second center member C**2** at P**6**. The end portions of first handle member H**1** and second handle member H**2** are pivotally connected together at pivot P**7**. It is noted that pivot P**7** is disposed above pivots P**5** and P**6**.

FIG. **3** also shows the various lever arms of hand tool **20**. Lever arm A is the distance between the crotch of first jaw member J**1** and pivot P**1**. Lever arm B is the distance between pivot P**1** and pivot P**2**. Lever arm C is the distance between pivot P**2** and pivot P**4**. Lever arm D is the distance between pivot P**4** and pivot P**5**. Lever arm E is the distance between pivot P**5** and pivot P**7**. Lever arm F is the distance between pivot P**7** and the distal end of first handle member H**1**. Therefore the mechanical advantage MA of hand tool **20** is MA=(B/A)×(D/C)×(F/E). In the typical hand tool **20** shown the length of the lever arms are about, A=0.5 inches, B=1.25 inches, C=0.8 inches, D=1.9 inches, E=1.1 inches, and F=6.25 inches. The mechanical advantage MA is therefore MA=(1.25/0.5)×(1.9/0.8)×(6.25/1.1)=about 33.74 which is generally referred to as 33.74 to 1. It is therefore observed that the mechanical advantage MA of the present invention **20** is substantially greater than the mechanical advantage MA of prior art hand tool **500** (33.74 vs. 16.4).

The preferred embodiments of the invention described herein are exemplary and numerous modifications, variations, dimensional variations, and rearrangements can be readily envisioned to achieve an equivalent result, all of which are intended to be embraced within the scope of the appended claims.

I claim:

1. A hand tool, comprising:

a first jaw member having a first end, an opposite second end, and an intermediate portion;

a second jaw member having a first end, an opposite second end, and an intermediate portion;

said intermediate portion of said second jaw member pivotally connected to said intermediate portion of said first jaw member at a first pivot P**1**;

a first center member having a first end, an opposite second end, and an intermediate portion, said first center member connected at exactly three pivot points, said first end of said first center member pivotally connected to said second end of said first jaw member at a second pivot P**2**;

a second center member having a first end, an opposite second end, and an intermediate portion, said second center member connected at exactly three pivot points, said first end of said second center member pivotally connected to said second end of said second jaw member at a third pivot P**3**;

said intermediate portion of said first center member pivotally connected to said intermediate portion of said second center member at a fourth pivot P**4**,

a first handle member having a first end, an opposite second end, and an intermediate portion, said intermediate portion of said first handle member pivotally connected to said second end of said first center member at a fifth pivot P**5**, said three pivot points on said first center member comprising said second pivot P**2**, said fourth pivot P**4** and said fifth pivot P**5**, all three pivot points fixed relative to one another;

a second handle member having a first end, an opposite second end, and an intermediate portion, said intermediate portion of said second handle member pivotally connected to said second end of said second center member at a sixth pivot P**6**, said three pivot points on said second center member comprising said third pivot P**3**, said fourth pivot P**4** and said sixth pivot P**6**, all three pivot points fixed relative to one another;

said first end of said first handle member pivotally connected to said first end of said second handle member at a seventh pivot P**7**, wherein said seventh pivot P**7** is disposed between (1) said fourth pivot P**4**, and (2) said fifth and sixth pivots P**5** and P**6**; and,

said fourth pivot P**4** disposed between (1) said second and third pivots P**2** and P**3**, and (2) said seventh pivot P**7**.

2. The hand tool of claim **1**, further including:

said jaw members having a crotch therebetween;

a lever arm A being the distance between said crotch of said jaw members and said first pivot P**1**;

a lever arm B being the distance between said first pivot P**1** and said second pivot P**2**;

a lever arm C being the distance between said second pivot P**2** and said fourth pivot P**4**;

a lever arm D being the distance between said fourth pivot P**4** and said fifth pivot P**5**;

a lever arm E being the distance between said fifth pivot P**5** and said seventh pivot P**7**;

a lever arm F being the distance between said seventh pivot P**7** and said second end of said first handle member; and,

a mechanical advantage MA of said hand tool being MA=(B/A)×(D/C)×(F/E).

3. The hand tool of claim **1**, further including said first jaw member and said second jaw member combining to form a sheet metal seamer.

4. The hand tool of claim **1**, further including:

said first jaw member, said second jaw member, said first center member, and said second center member each being a single member.

5. The hand tool of claim **1**, further including:

said seventh pivot P**7** being approximately equidistant from each of said fourth pivot P**4**, said fifth pivot P**5**, and said sixth pivot P**6**.

6. In a hand tool of the type having (a) a first jaw member having a first end, an opposite second end, and an intermediate portion, (b) a second jaw member having a first end, an opposite second end, and an intermediate portion, (c) the intermediate portion of the first jaw member pivotally connected to the intermediate portion of the second jaw member at a first pivot P**1**, (d) a first handle member having a first end, an opposite second end, and an intermediate portion, (e) a second handle member having a first end, an opposite second end, and an intermediate portion, (f) the first end of the first

handle member pivotally connected to the first end of the second handle member at a seventh pivot P**7**, the improvement comprising:

a first center member having a first end, an opposite second end, and an intermediate portion, said first center member connected at exactly three pivot points, said first end of said first center member pivotally connected to the second end of the first jaw member at a second pivot P**2**;

a second center member having a first end, an opposite second end, and an intermediate portion, said second center member connected at exactly three pivot points, said first end of said second center member pivotally connected to the second end of the second jaw member at a third pivot P**3**;

said intermediate portion of said first center member pivotally connected to said intermediate portion of said second center member at a fourth pivot P**4**;

said second end of said first center member pivotally connected to the intermediate portion of the first handle member at a fifth pivot P**5**;

said second end of said second center member pivotally connected to the intermediate portion of the second handle member at a sixth pivot P**6**, wherein the seventh pivot P**7** is disposed between (1) said fourth pivot P**4**, and (2) said fifth and sixth pivots P**5** and P**6**;

said fourth pivot P**4** disposed between (1) said second and third pivots P**2** and P**3**, and the seventh pivot P**7** said three pivot points on said first center member comprising said second pivot P**2**, said fourth pivot P**4** and said fifth pivot P**5**, all three pivot points fixed relative to one another; and

said three pivot points on said second center member comprising said third pivot P**3**, said fourth pivot P**4** and said sixth pivot P**6**, all three pivot points fixed relative to one another.

7. The hand tool of claim **6**, further including:

the jaw members having a crotch therebetween;

a lever arm A being the distance between the crotch of the jaw members and the first pivot P**1**;

a lever arm B being the distance between the first pivot P**1** and said second pivot P**2**;

a lever arm C being the distance between said second pivot P**2** and said fourth pivot P**4**;

a lever arm D being the distance between said fourth pivot P**4** and said fifth pivot P**5**;

a lever arm E being the distance between said fifth pivot P**5** and the seventh pivot P**7**;

a lever arm F being the distance between the seventh pivot P**7** and the second end of the first handle member; and,

a mechanical advantage MA of said hand tool being MA=(B/A)×(D/C)×(F/E).

8. The hand tool of claim **6**, further including the first jaw member and the second jaw member combining to form a sheet metal seamer.

9. The hand tool of claim **6**, further including:

said first jaw member, said second jaw member, said first center member, and said second center member each being a single member.

10. The hand tool of claim **6** further including:

said seventh pivot P**7** being approximately equidistant from each of said fourth pivot P**4**, said fifth pivot P**5**, and said sixth pivot P**6**.

* * * * *